2011

Scald Conditions

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Cranberry Scald – What do we know & what is our plan of action?

Putting the pieces together…

- What we (think) we know
- Relations we need to know
- Scald Events (& disparities)
- What are the combinations?
- Forecasting attempts
- Remebiation issues
- Conceptual Framework
- Creating a Plan of Action

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College of Natural, Applied and Health Sciences at Kean University

Thank you for your invitation…

What we (think) we know…

- ✓ All berries/fruit (even vegetables) susceptible
- ✓ Field v. harvest v. production v. treatment
- ✓ Fungal contributions (e.g., G. Vaccini 1889)
- ✓ "Steam" scald and "Heat" scald
- ✓ Environmental Conditions
- ✓ Management Practices
- ✓ Cultivar & Phenophase
- ✓ Time of day/Duration
- ✓ Mitigation/Prevention

(Caveat: Much evidence but little comprehensive field/lab or experimental work)

Damage: Superficial injury to 'cooked' on the vine…

Factors: Heat – Cold – Storage - Processing

Diagnosis: Scald – Blast – Rot – Relations

What exactly is happening?

- Physiological Breakdown
  - Fruit stage of development
  - Coloration, surface texture
  - Cooling mechanisms of plant
- Due to Environmental "Shock" of the plant system
  - Intense solar radiation, excessive field/canopy temperatures, & varying wet/dry combinations
  - "Activation" of "ever-present" fungus

Identification & Collateral Damage

- Lightly colored "watery area" on surface of cranberry
- Multiple spots, presentation "side" (link to irrigation water & "steaming"?)
- Surface lesion enlarges, berry softens, and turns brown
- Berry "Rot" sets-in and fruit becomes misshapen, soft-mushy
- Any flowers, shrivel/die-back = "Blast"
- Any leaves, discoloration = damage/die-back (red rust, rose mildew)
- Plant and berries susceptible to additional injuries/pathogens/insects
- Large variability within/between bogs & according to management practices

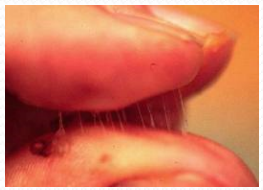
Relations we need to know…

Cranberry Physiology

- Cultivar behaviors vary
- Phenophase (berry/plant)
- Presence & prevalence of fungus
- Stress level (stomatal "failure")
- Plant water partitioning and demand (root, leaf, stem, fruit)
- Heat shock proteins (cold too)
- Sugar & Mineral contents
- Tissue/membrane & physical characteristics of plant system

Physical Environment

- Berry "presentation" & time of day; solar spectrum definition
- Fruit & field temperatures
- Duration & frequency of exposure
- Bog soil properties/conditions
- Management irrigation/cooling
- Water table level/management
- Edge effects; crop area affected
- Herbicide, insecticide, fungicide applications; aeration practices



How do we find out? => Field, Lab, and Experimental

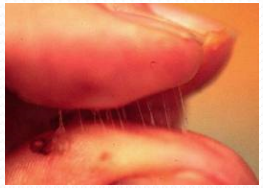
…or that we need to investigate…

Cranberry Physiology

- Phenophase – fruit stage/color are important to occurrence
- Physiological – disorders, maturity, nutritional imbalances
- Bio-factors – pathological, animal, entomological, genetic variation and alterations

Physical Environment

- Climate/Weather and local variations across small regions
- Water relationships and light interactions; cultivation
- Mechanical damage, sanding
- Chemical residues, growing medium, vegetative matter



To do so => Need specific investigations/research

What should we change or not change? We don't clearly know

Let's focus on the Physical Environment and Factors

What do we already know?

Temperature

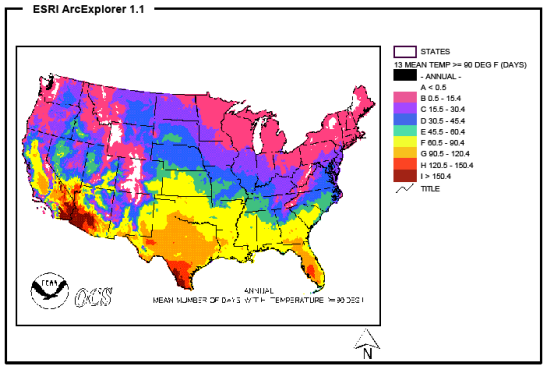
- Consider number of average high temp days of 90 or more by cranberry regions in U.S. (vs. highest temps on record)

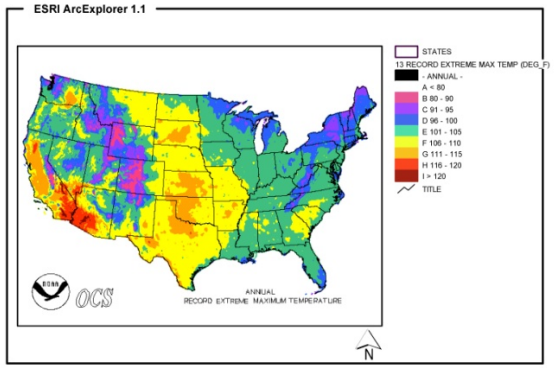
Solar Radiation

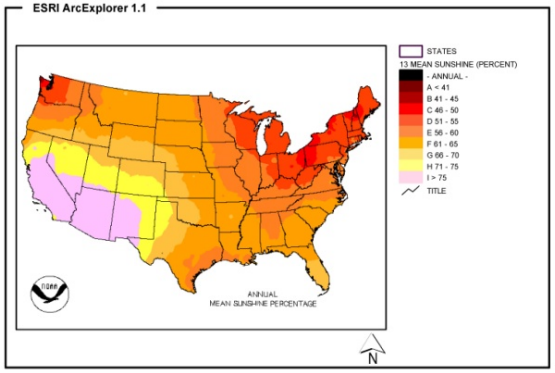
- Consider percent annual sunshine received (vs. cloud cover, duration, and similar)

More or less prone?

Consider Pac-NW, WI, MA, and NJ regions…







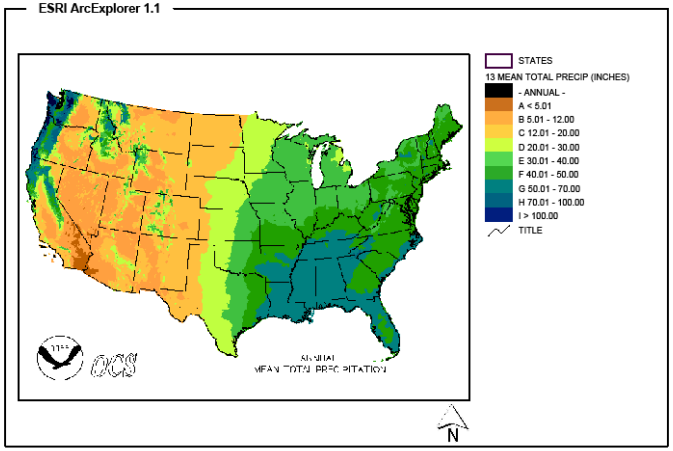
What are the other mean conditions and variations?

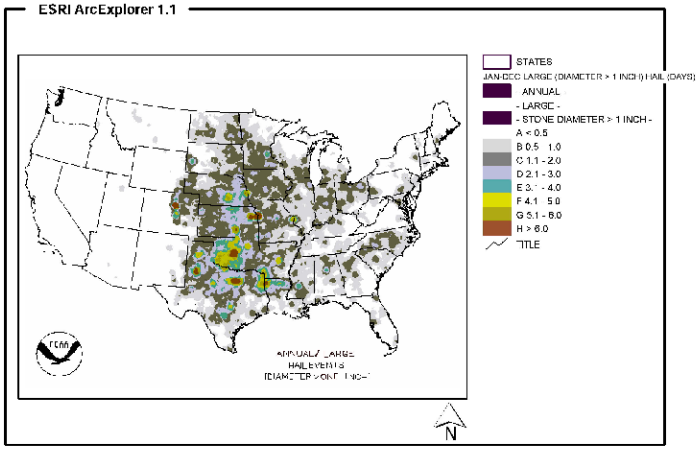
What else do we already know?

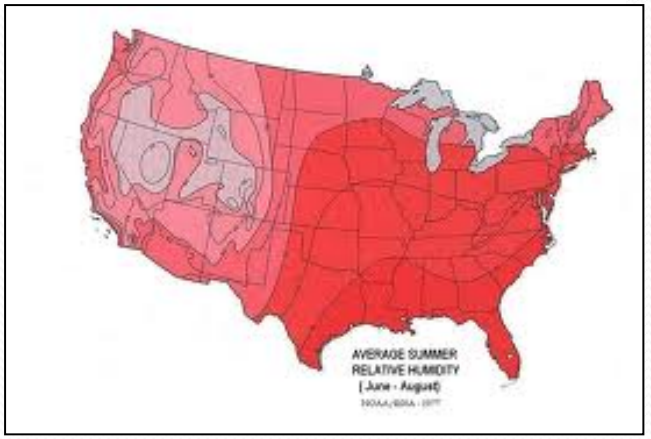
Rainfall, Moisture, Hail…

- Mean annual rainfall across the U.S. (vs. season and mean values of RH or dewpoint) and compare to sun

More or less prone?





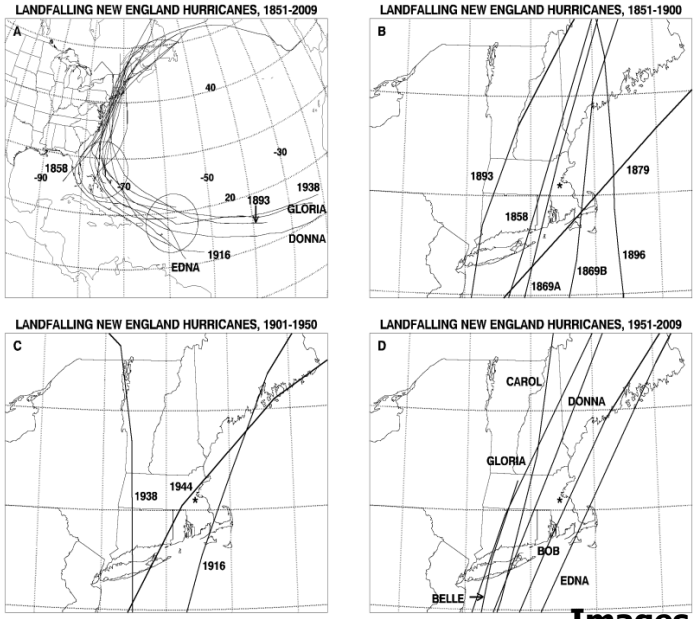


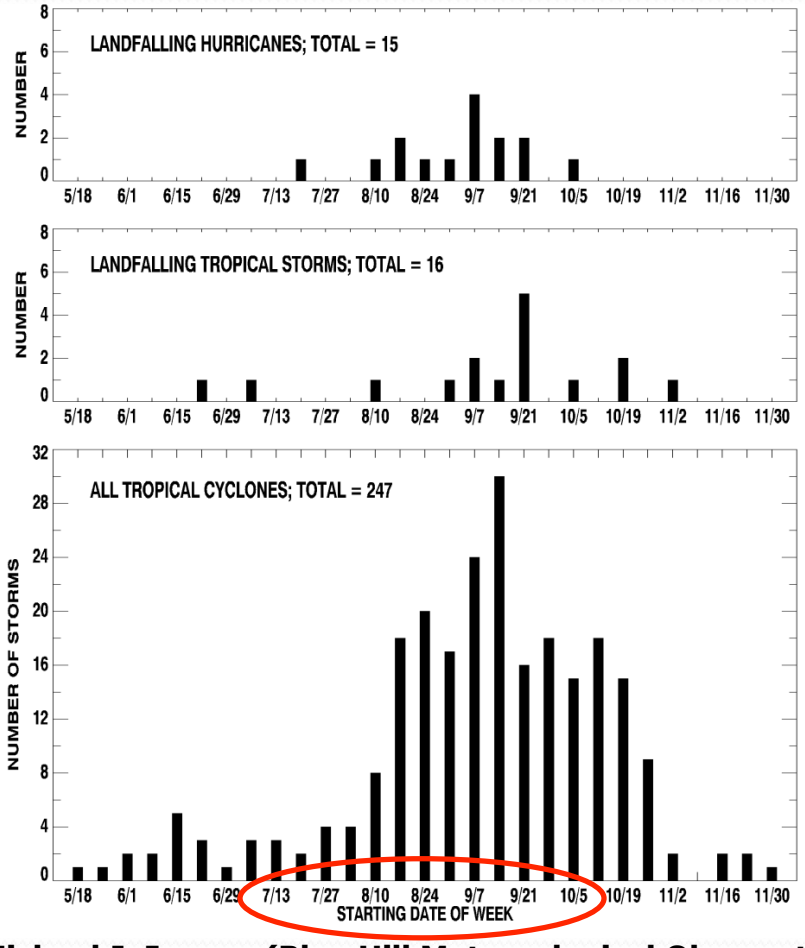
What else do we already know?

Tropical Storms/Hurricanes

More or less prone?

- Storms 'typical' each year
- How close to coastline
- Indirect effects are common
  (e.g., subsidence clearing and higher temperatures, wind speeds increase)



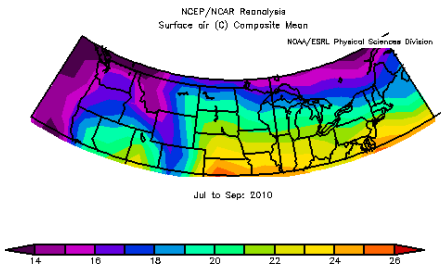


Images from Michael J. Iacono (Blue Hill Meteorological Observatory)

Now how do these conditions relate to scald events?

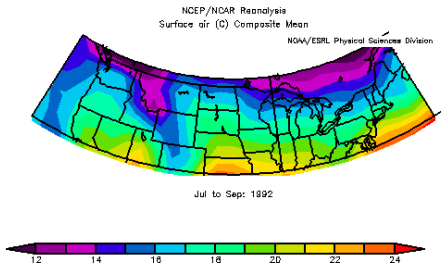
Scald Events (& disparity)…

DETAILS



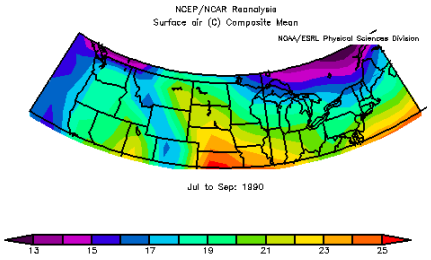
Summer 2010

- Temps above
- "Drought" & Rains



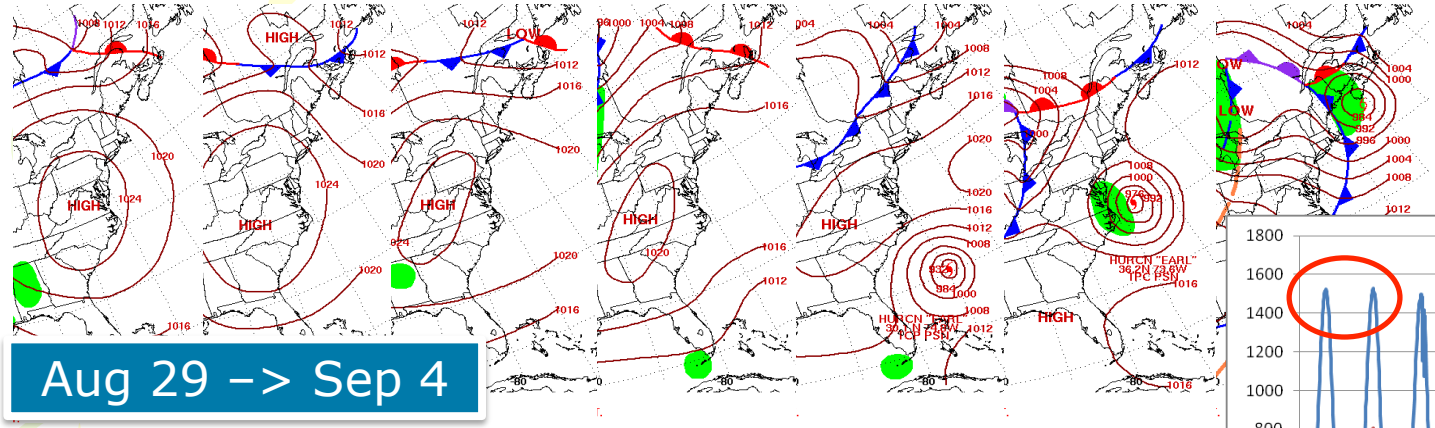
Summer 1992

- Temps normal
- Rainfall



Summer 1990

- Temps normal
- Wx conditions

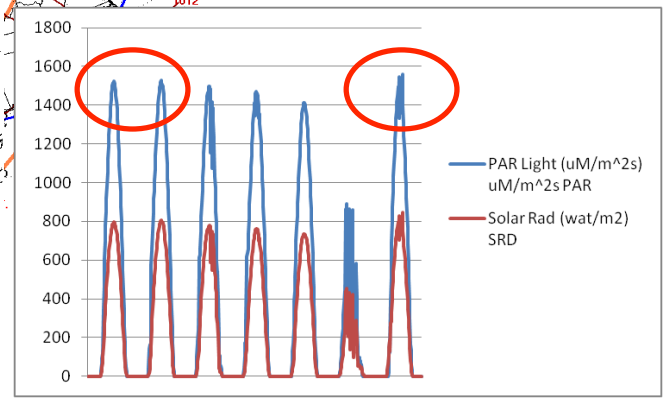


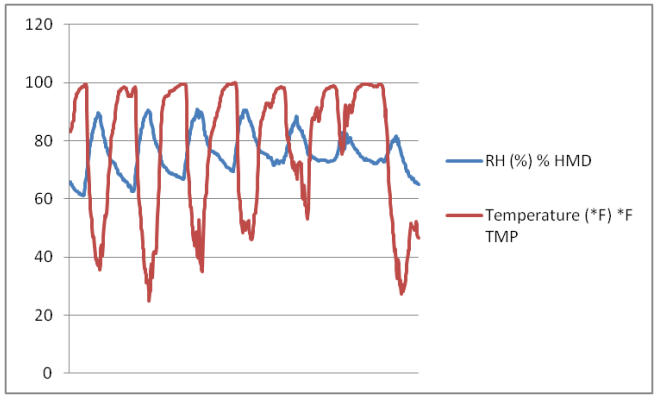
Aug 29 –> Sep 4

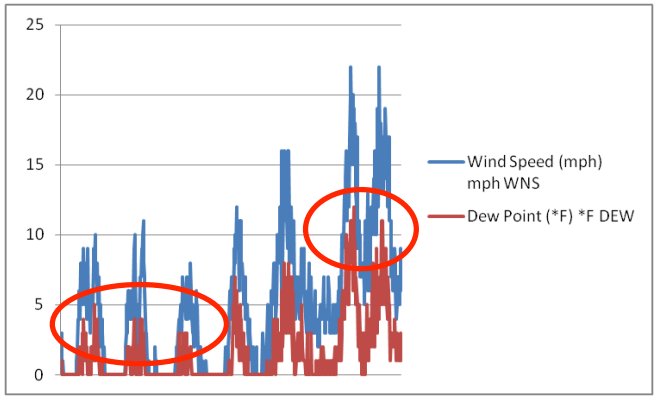
HURRICANE EARL TOO?!

So…do we have a "Smoking Gun"?

- High Pressure Day to Day
- High Solar Radiation
- High Temperatures
- Low Dewpoints first
- High Dewpoints later
- Light Winds most of period







Compare to Summer 2010

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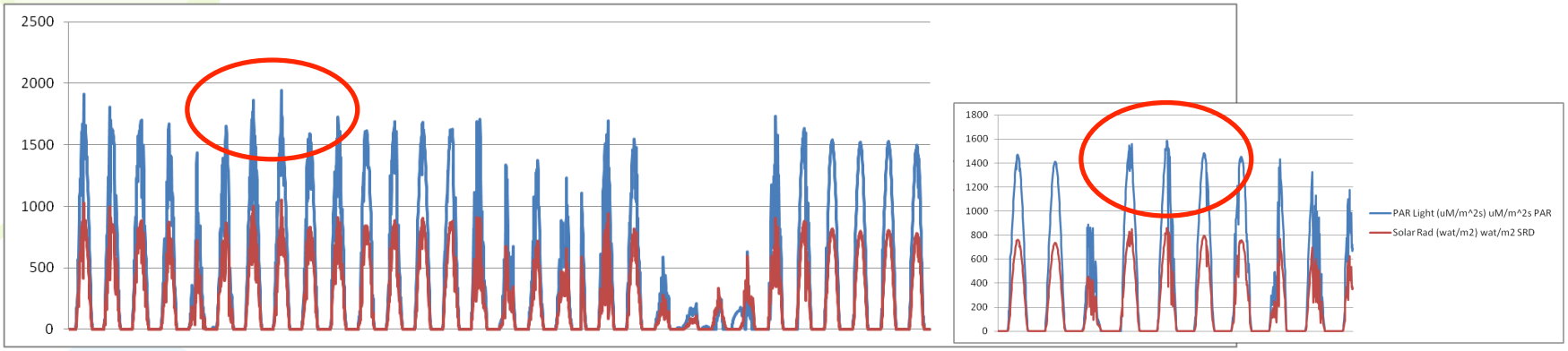
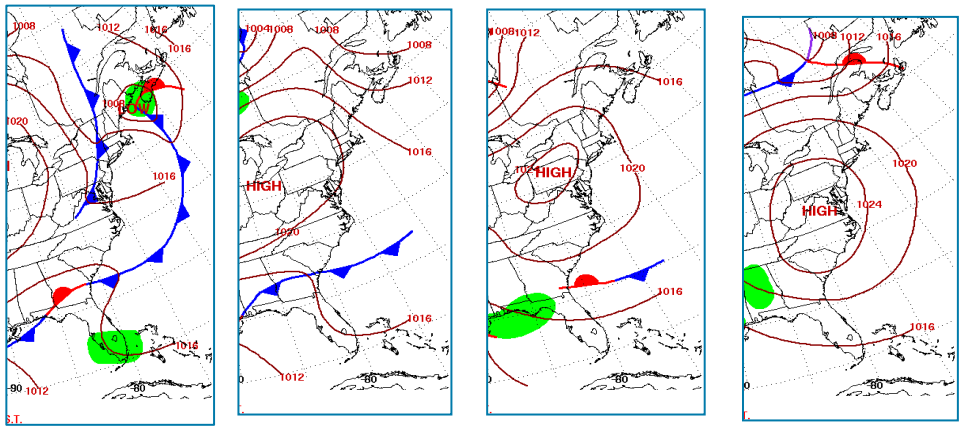
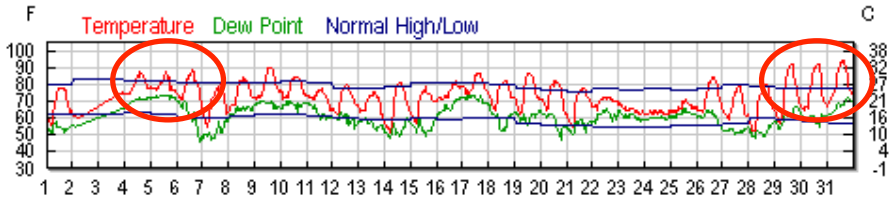


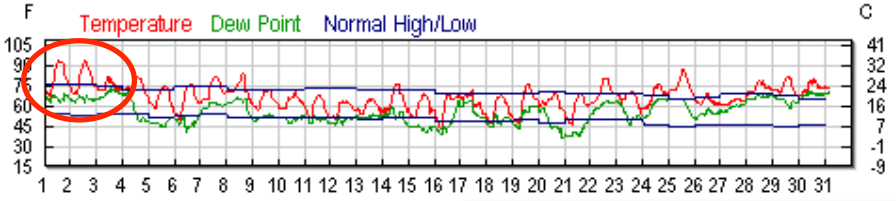
What the Aug and Sep plots show…

- Stronger solar radiation
- Variable weather pattern
- Aug 26-29 low dewpoints
- Lighter winds



Plymouth Municipal Airport

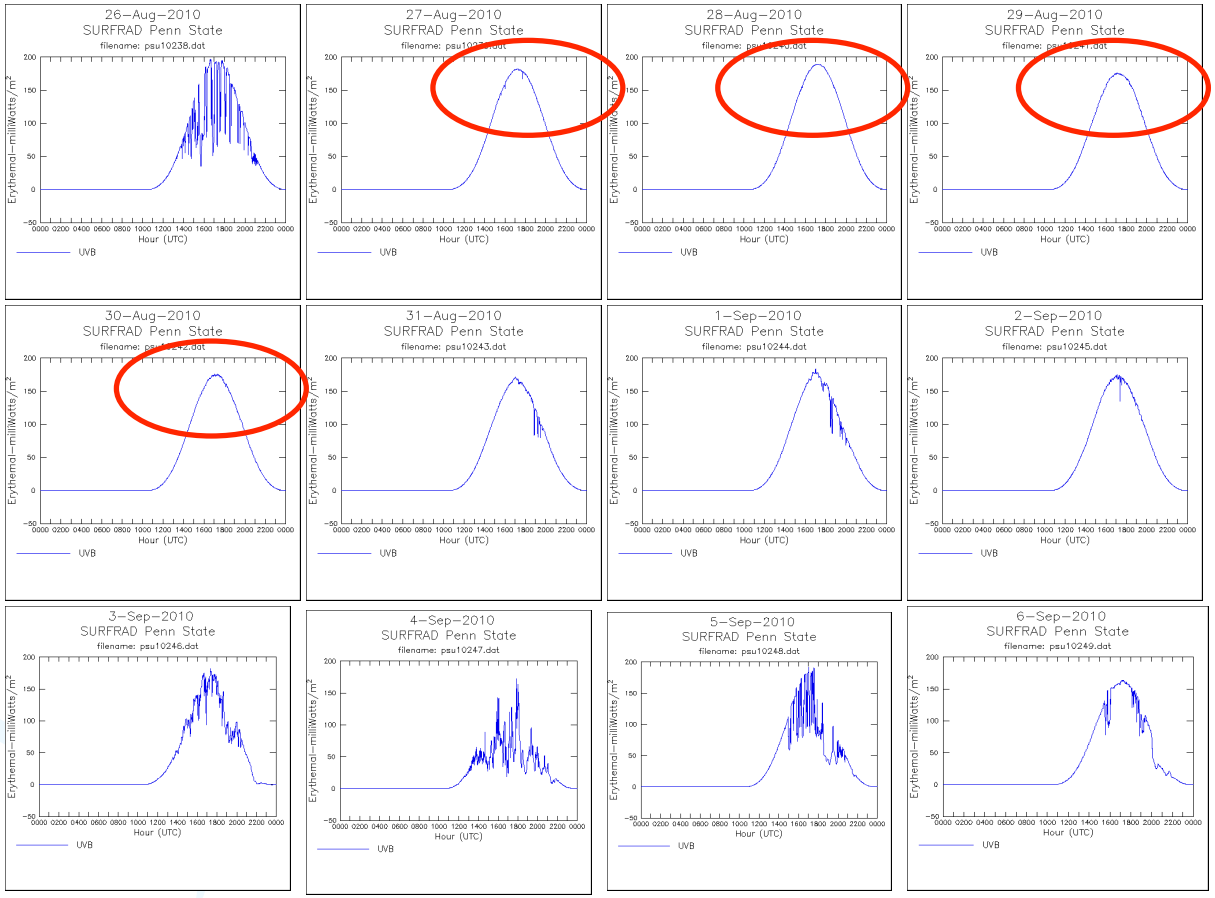




Weather Underground

“Nearby” in Pennsylvania: UV-B

Aug 26 – Sep 6, 2010



Was it Aug 28-29 or Aug 31-Sep 1 or Sep 2-3 or…???

Peak UV-B values in Aug but longer duration in Sep

Questions and additional data…

- "Steam" Scald
- "Heat" Scald
- Combination?
- "Heat" preceded "Steam"?
- "Heat" followed "Steam"?
- Cranberry/Canopy Temperatures?
- Durations of exposure?
- Was it a combination?

- How would we know difference?
- How would we be able to detect and measure?
- What other data do we need? => Bog

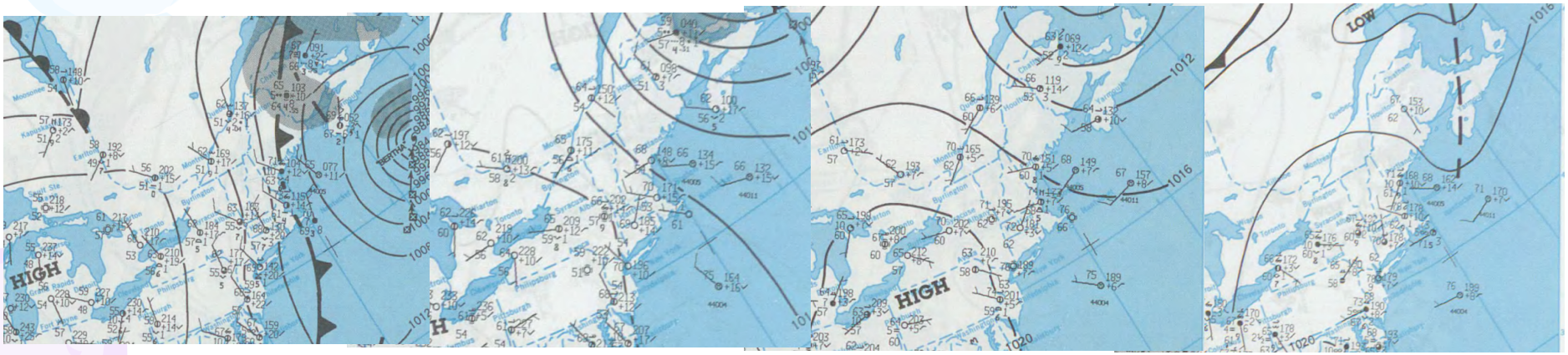
UV Index values: Higher than average for time period

AQ Index values & Ozone: Need to be determined

Bog specific information helps…

How does that help?

- Use from 1990 scald event in NJ (Aug 1-2-3-4)
- Consider fruit with regard to temperature, moisture, and solar conditions collectively



HURRICANE BERTHA TOO?!

Summer 1990

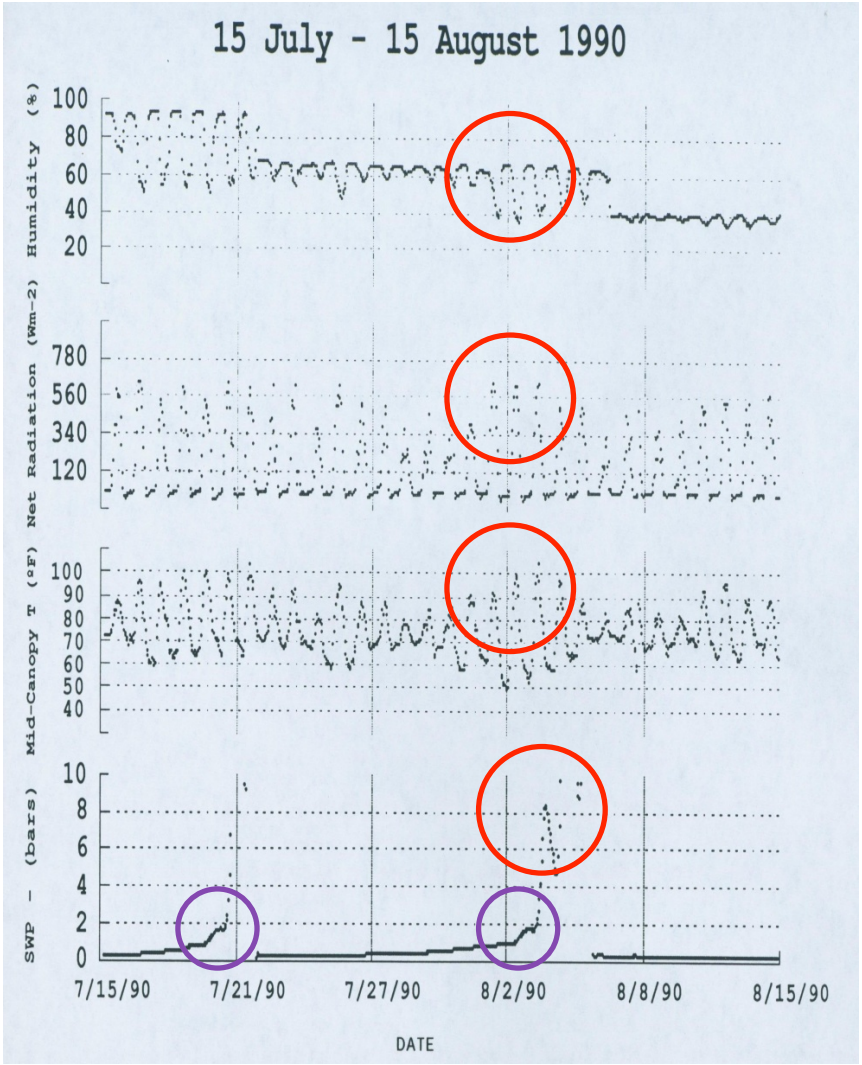
"CLASSIC" SUN SCALD EVENT

What did we observe?

Summer 1990

- Bog stress level
- Stomatal behaviors
- Management practices
- Weather conditions

- Role of T, Humidity, Wind values?
- Duration of exposure?
- UV/Vis impacts?
- AQ/Ozone impacts?
- Sea Breeze?

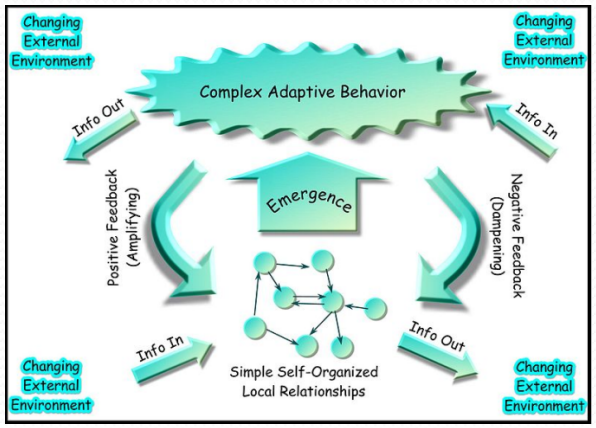


What are the Combinations?

(and why the significant variations?)

Cranberry Bog

- Canopy conditions of plants
- Presence of fungus/other
- Soil Water Potential
- Soil Temperatures
- Management Practices for irrigation/sprinkler or cooling
- Nutrients and Physiology



Wikipedia

Environment

- Atmospheric (Wx) Conditions
- Evaporative Demand/Wind speed
- Lack of rain (or too much prior)?
- Low dewpoint temperatures
- Solar Radiation (amount, duration, exposure/presentation)

…or a "Family" of scald behaviors due to various combinations of factors…

Environmental

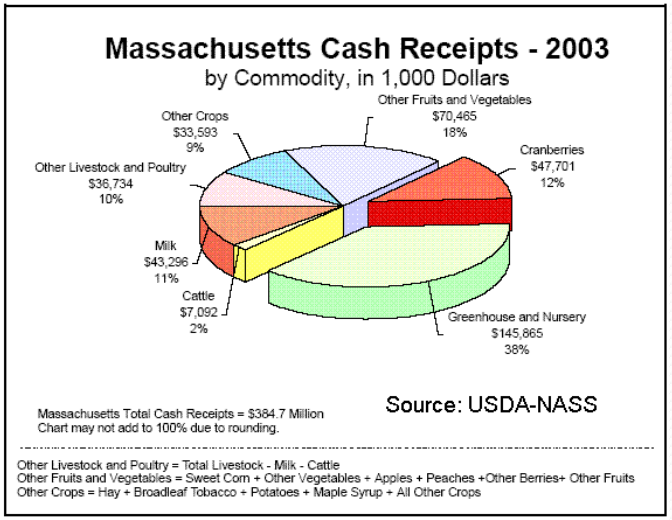
Physiological

Management

Forecasting attempts – some success?

Method developed at Rutgers University

Focus was on maximum temperatures
and lower dewpoints with evaporative demand
and wind speeds (1990 event data analysis)



What's been accomplished since then?

Network data stations, bog monitoring, and
revised management practices…yet still problems?

Opportunity is there for localized bog forecasts but…

Do we know what to measure and when and why and how?

Should we be using additional data such as the UV Index and AQ Index?
Should we be using gridded/GIS data forecasts from the NWS/NOAA?
Should we be completing some research to find out what we don't really know?

Remediation & Climate Issues: A-M-P

Avoidance

- Hope for a "Good" summer and no scald occurrence
- Timing and Weather Conditions do not present when berry is most susceptible
- Grow something else or move location to "better" climate
- Fungus not an issue

Mitigation

Irrigation/Sprinkler (cooling)

Flooding ("cover" cooling)

Dusting (albedo/heating)

Aeration (cooling/drying)

Chemical Treatment

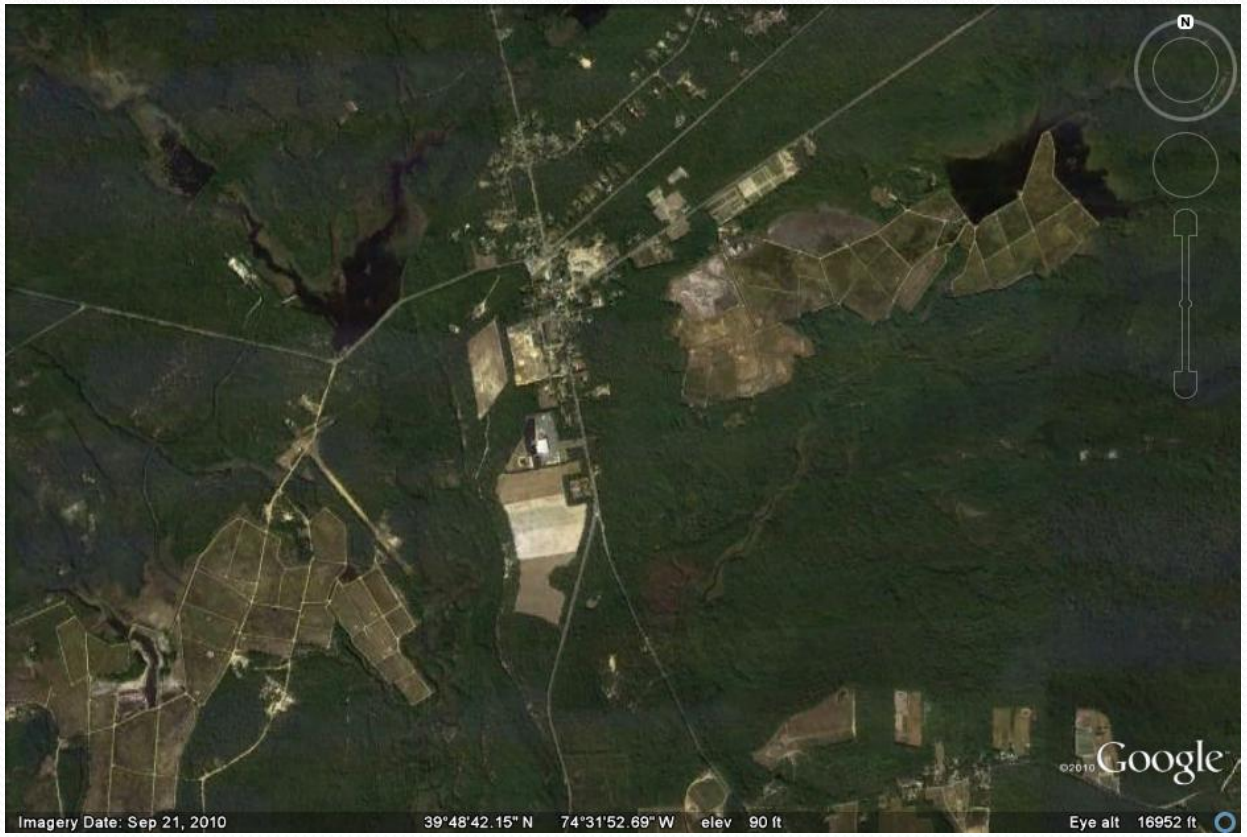
Prevention

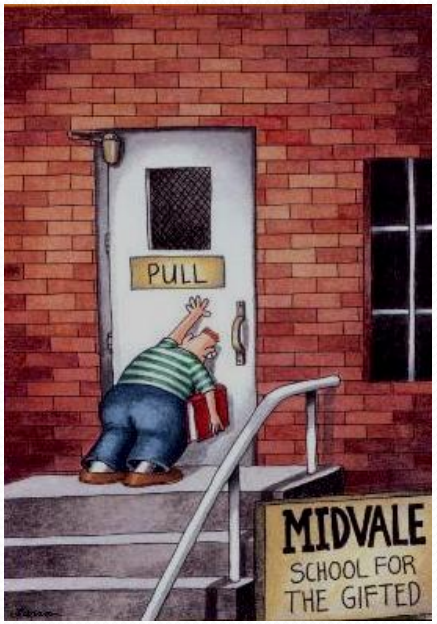
Fungicide/IPM approach

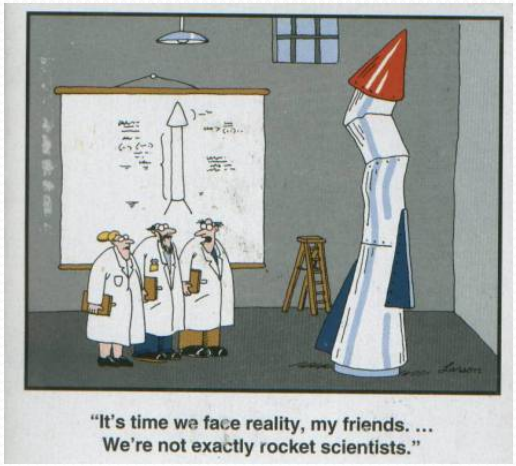
Genetic/other techniques

Some of above mitigations

Conceptual Framework…







Confounding Factors & Precursors are all known?
Can we Monitor the Activation Mechanisms?

Creating a Plan of Action

Simulate

Modeling & Observational studies to depict what is happening interactively between plant and environment (as related to field management practices)

Test

Verification to relate specific damage (physiology) to key factors as observed in the field and lab and by various experiments

Actively Remediate

Controlled trials for A-M-P to show value of prediction/management and to test/verify specific methods or practices and cost/efficacy

Track for Integrated Management

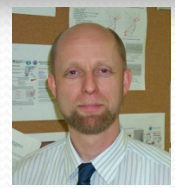
"Best Practices" for combinations of most important environmental & plant factors to provide forecasts that account for these on a daily basis with use of GIS modeling & visualization methods and risk assessment

We can do this...scald should not be a mystery!

Thank you for your time...

Questions???

...Or Discussion...



Dr. Paul J. Croft

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